

## Swanson, Greg

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**From:** Swanson, Greg  
**Sent:** Tuesday, February 06, 2001 3:19 PM  
**To:** Swanson, Greg; Meyers, Charles; Hawkins, Jim  
**Subject:** FW: RSRM RRC Issues

FYI

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**From:** Swanson, Greg  
**Sent:** Tuesday, February 06, 2001 3:08 PM  
**To:** Craig Bryson; Doug Wells; Kenneth Swaim; Lisa Hediger; Marcus Gregg; Pravin Aggarwal; Preston McGill; Sam Russell; Steve Androlake; Terry Hamm  
**Cc:** Holt, Dan; Spanyer, Karen; McConnaughey, Paul; Cash, Steve  
**Subject:** RSRM RRC Issues

Thiokol presented to the MSFC Fracture Control Board this morning about reuse of nonconforming hardware. Dan Holt from the RSRM project office asked that we give them a "heads up" on the concerns the Fracture Control Board has with the Relative Radius of Curvature (RRC) methodology Thiokol is using to determine residual stresses in RSRM case segment stub rings. What follows is my summary, in a preliminary form, of the issues the FCB has with the RRC methodology.

One part of the flight rational for reuse of distorted segments is the RRC determined residual stress. The residual stress must be limited to avoid stress corrosion crack growth of a small flaw (0.025 x 0.025 corner crack). This size flaw is one that could escape NDE after also surviving proof pressure testing.

The main issue the FCB has is that the RRC residual stress calculation is based on numerous assumptions that have not been verified with test data. An elastic/plastic analysis to determine residual stresses is highly dependent on load history (path), Finite Element Model (FEM) mesh density, and FEM solution algorithm. From the presented materials and an overview of the Thiokol report it is apparent that no testing was done to verify the RRC methodology. The RRC methodology is a new and novel approach that should be test verified before use for flight programs.

The FCB felt that removing knowledge of the residual stress in the stub ring does weaken the flight rational in regards to protection from stress corrosion cracking. The stub ring still has for supporting rational for flight the proof testing, NDE inspections, and environmental barriers (paint, foam, grease, etc.).

The FCB would also like to know if the stub ring is the highest stressed part due to cavity collapse loads or if the local deformation also highly loads the membrane.

A final issue is the multi cycle reuse of hardware and tracking of the plastic stress and strain over a segments life. This is an "aging fleet" issue and is not a direct responsibility of the FCB, but the FCB is concerned with the potential low cycle fatigue (LCF) and crack initiation that can be caused by multiple plastic cycles.

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